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Radical innovation, network competence and the business of body disposal

Introduction

A sustainable form of existence in which the requirements of the present generation can be satisfied "without compromising the ability of future generations to meet their own needs" (Anonymous, 1987, p. 54) represents a major societal challenge. Innovation provides a means through which the behaviour of individuals, organisations and governments might be re-thought to mitigate the damaging effects of consumption. Indeed, radical innovation can be pivotal in bringing about the behavioural adjustment needed to move towards a more sustainable existence (Schot and Geels, 2008). Understanding how to progress innovation from R&D projects through to market acceptance has directed academic and practitioner interest towards niche management in which technological and social change are combined via processes of learning, setting of expectations and networking (Kemp *et al*., 1998). This paper focuses specifically on the networking process associated with radical sustainable innovation.

The networked nature of innovation has been a key research theme for some time (e.g. Pittaway *et al*., 2004; Robertson and Langlois, 1995;Voudouris *et al*., 2012), as has the structure and functioning of networks associated with radical sustainable innovation (e.g. Caniëls and Romiijn, 2008). However, in addition to structure and function, a key aspect of the networking process is an organisation's network competence i.e. its ability to draw from the skills and resources of others parties, via the initiation and development of relationships (McGrath and O'Toole, 2013; Ritter *et al*., 2002; Ritter and Gemünden, 2003; Walter *et al*., 2006). Understanding of the role of network competence in bringing innovations to market exists (e.g. Aarikka-Stenroos and Sandberg, 2012; Chiu, 2009) but the significance of this

aspect of the networking process in relation to radical sustainable innovation remains unexplored. This study shows how network competence enables such radical innovation and to do this, focuses on the practice of human body disposal.

Body disposal is a consumer service, but bringing to market new disposal technologies requires network formation around innovative market players, and so relationship initiation and development in a business context is important. In this paper, the examination of network competence relating to radical sustainable innovation concentrates on cremation alternatives. Cremation is the norm or at least an accepted disposal method in many Western countries (Walter, 2005), shaped by religion, state intervention and shifts in market acceptance. Incremental innovations such as improved efficiency of modern cremation systems or the recycling of by-products from the process might render this method more environmentally benign. However as with other industries (Hellström, 2007; Kemp, 1994), the contribution of such incremental improvements to marked reductions in environmental burdens is debatable. More critical is to determine how the dominant technology might be substituted. Monaghan (2009) identifies replacements for current cremation technology, but does not provide empirical evidence of its introduction. This paper examines the networking process, and specifically the role of network competence in bringing to market radical alternatives to cremation technology and for which the potential benefit to society requires the involvement of a broad set of actors (Magnusson, 2003).

The literature review connects network competence with the networking process associated with strategic niche management, which has been the focus of studies of radical sustainable innovation. The methodology section explains the case study approach involving two focal companies and outlines key data sources. The findings reveal the knowledge and skills employed by the two companies to initiate, use and maintain relationships to access relational

resources and progress cremation alternatives towards market acceptance. These findings are discussed in relation to existing knowledge and suggestions for further research made.

Literature

Innovation: radical and sustainable

This paper concentrates on technology-based improvements associated with product and process innovations. Numerous explanations exist of technological developments which are identified as being new-to-the world and thus considered radical (Linton, 2009). A consistent theme in the work on radical innovation is that it consists of unique configurations of existing systems (Seidel, 2007) or advances in product and process functions beyond the capability of existing technology. Additionally, customers are unfamiliar with such radical innovation yet it is perceived by users as offering substantial benefit (Linton, 2009; Story *et al*., 2009; Veryzer, 1998). Efforts to revolutionise existing technical and social systems in a move towards more sustainable consumption are apparent across sectors (Hellström, 2007). Regarding transport and mobility for example, attempts include substitutes to individual automobile ownership, technology and infrastructure alternatives to the combustion engine (Loorbach *et al*., 2010) and radical transport policies (Ieromonachou *et al*., 2004). This investigation focuses on alternatives to existing cremation technology and which might offer more sustainable forms of consumption.

Strategic niche management

An important research stream connected to innovation that is radical and sustainable is strategic niche management (Schot and Geels, 2008). A key principle of this work is that for sustainable R&D projects to achieve market acceptance, there has to be technical and social

change. This change is sought at multiple levels, namely niche, regime and landscape (Geels, 2002).

Landscapes represent the overall setting in which social and technical systems operate, consisting of economic, political and cultural dynamics that are relatively stable and slow to change (Geels, 2002). At the micro level, specific actors operate in niches, collaborating on projects that may result in innovations in incumbent technical and social systems within a regime. Numerous projects are played out and these will have varying degrees of success, yet the cumulative learning from the different niche-level projects can contribute to and shape the nature and direction of social and technical change within a regime (Schot and Geels, 2008). Regimes sit at the meso level, consisting of institutional knowledge and patterns of behaviour that are embodied in and bind together technical and social actors such as firms, users, industry bodies, public authorities and regulators (Geels, 2002). The interplay in and between regimes and niches is framed within somewhat immutable landscapes. This interchange can result in shifts at the broader macro level that landscapes represent.

Research interest initially focussed on ways in which innovation might be nurtured within protected spaces of niches. Such niches enable the experimentation with and development of technology or concepts alongside user practices and regulatory frameworks to bring about significant and persistent changes in existing systems (Ieromonachou *et al*., 2004; Monaghan, 2009; Schot and Geels, 2008). However, subsequent work questioned the insulated nature of niches (Möller, 2010) and acknowledged that change was more likely through dynamic processes in play between the different levels whereby niche innovations develop impetus internally, landscape changes put pressure on regimes and disruption within regimes presents opportunities for niche innovations (Schot and Geels, 2008).

The relatively stable landscape of body disposal frames this study's focus on the interplay between innovation niches and the regime of human disposal.

Innovation dynamics: from networking process to network competence

Early niche management research associated with radical sustainable innovation centred on the dynamic processes of learning, articulation of expectations and visions and networking (Kemp *et al*., 1998). As we noted, attention has since been directed at examining these processes at multiple levels of niche, regime and landscape (Geels, 2002). While this shows how R&D projects lead to market approval, scope remains to further develop understanding of the contribution of the networking process to radical sustainable innovation.

Radical innovation can disrupt the incumbent network of relationships within a specific landscape, resulting in alternative arrangements to ensure resource access and activity performance. The networking process that leads to these new arrangements is explained in terms of formation and configuration (Pittaway *et al*., 2004). The process by which networks of relationships are formed, features in numerous business and innovation studies (see Pittaway *et al*., 2004 for a review of this). With regards to configuration, studies have examined the structure and functioning of networks in relation to innovation performance (e.g. Canïels and Romijn, 2008; Zeng *et al*., 2010). Such work indicates the networked nature of innovation, but does not account for the competence (Cooke, 1996) necessary to bring about the formation and functioning of relationship networks and through which R&D projects progress to market approval.

Competence features extensively in several research disciplines and is closely connected to capability (e.g. Calrsson and Eliasson 1994; Collis 1994). Broadly speaking competence can be described as the ability to do something effectively by means of specific knowledge and skills, i.e. by means of specific capabilities. From an economic perspective Carlsson and Eliasson (1994) characterise economic competence as 'the ability to identify, expand and exploit business opportunities' (p.687), suggesting that this competence is made up of distinct types of capabilities. In strategic management literature capabilities are distinguished according to whether knowledge and skills are used to perform routine functional activities, to learn, adapt and innovate (in response to internal and external pressures) or for creative resource combination or strategy configuration ahead of competitors (Collis 1994; Winter 2003). The close association between competence and capability means that some authors use these terms interchangeably (e.g. O'Connor and De Martino, 2006; Ritter and Gemünden, 2003). With this in mind, the word competence is used, but in doing so, this study draws from research that examines either competence or capability in relation to networking and innovation.

[INSERT TABLE 1 ABOUT HERE]

If networking is the formation and configuration of networks of relationships, then network competence can be explained as the ability to initiate, use and maintain relationships by means of specialist knowledge and social or relational skills (Ritter and Gemünden, 2003; Walter *et al*., 2006). Besides network competence (Aarikka-Stenroos and Sandberg, 2012; Ritter and Gemünden, 2003) this ability has also been associated with phrases such as network capability (Walter *et al*., 2006) and network mobilisation capability (Partanen *et al*., 2008). Various authors introduce terms and definitions associated with network competence,

but only Ritter and Gemünden (2003) and Walter *et al*., (2006) indicate the knowledge and skills as well as activities connected to it (see Table 1).

Ritter and Gemünden (2003) suggest that knowledge is specialist and can be characterised according to whether it is technical, economic or partner-specific. *Technical* knowledge helps understand partner technological needs and capabilities while *economic* knowledge enables inputs as well as the allocations of costs and prices to be determined. With regards to partner specific knowledge, Ritter and Gemünden (2003) identify that which is *organisational*, relating to partner operations, resources and personnel, and *experiential*, resulting from interactions with a particular partner. Walter *et al*., (2006) do not distinguish between the nature of partner knowledge, rather, they explain it as structured and organised information on suppliers, customers and competitors. Aside from specialist knowledge, social or relational skills (Ritter and Gemünden, 2003; Walter *et al*., 2006) such as communication and cooperation are noted as being important because of their capacity to induce positive reactions or changes in behaviour amongst potential or existing network partners. The key point is that it is the application of specialist knowledge and social skills to span organisational boundaries, communicate internally (Walter *et al*., 2006), engage in relationship-specific and cross-relational activities (Ritter and Gemünden, 2003) which in effect is an organisation's network competence. Ritter and Gemünden (2003) and Walter *et al*., (2006) determine that network competence contributes to innovation success among SMEs and the performance of university spin-off firms.

Aside from their contribution to the innovation performance of new and small enterprises, network competences have been connected to the innovation process itself. As an iterative process, radical innovation is explained as consisting of phases of discovery,

incubation, acceleration and commercialisation (Story *et al*., 2009). Network competence is relevant to these different stages, enabling access to resources held by other actors and engaging those parties in the execution of activities as part of the innovation process. Aarikka-Stenroos and Sandberg (2012) examine how network competence is used in the innovation process but only at the discovery (R&D) and commercialisation phases. This inquiry develops understanding of the contribution of network competences in the phases of incubation, acceleration and commercialisation associated with bringing radical, sustainable innovation to market. Key questions that this research seeks to answer are:

- how does network competence contribute to the incubation, acceleration and commercialisation phases of the innovation process?
- how do social skills and specialist knowledge contribute to the creation, use and maintenance of relationships for radical sustainable innovation?

Methodology

To answer these questions, an abductive research approach (Dubois and Gadde, 2002) and case study design were used. The approach allowed systematic combining of empirical data with concepts, and rather than being framed by à priori theory, themes arose and adjustments were made as the investigation progressed. Equally, the network investigated emerged during the research process. This abductive approach was central to the case design, enabling the emergent phenomenon of interest (network competences in radical sustainable innovation) to be examined within the context of body disposal where distinctions between the phenomenon and context are not evident (Yin, 2009), and making such a separation would diminish the understanding derived. The unit of analysis in this investigation were two organisations undertaking networking activities to bring radical sustainable innovation to the international

market for body disposal. The use of two case organisations, each seeking to provide an alternative to cremation technology, allowed for literal replication (Yin, 2009). Although the companies were at different stages of the innovation process, exploration of network competence in the incubation, acceleration and commercialisation phases was possible.

The investigation was based on a longitudinal study using secondary and primary sources in two phases of data collection and analysis. Secondary sources dating from 2007 onwards were drawn from newspaper features, professional publications and internet pages, serving to develop understanding of body disposal provision, the role and activities of controlling and influencing organisations as well as being used to triangulate primary data. Primary research started in 2009, was built around understanding viewpoints of key actors on radical cremation alternatives, the framing of which was refined from phases one and two of the research process. Primary data was generated via participant observation at three industry conferences and twelve in-depth, qualitative interviews (Table 2 shows these activities according to research phase). Industry conferences associated with crematoria activities and funeral directing practices were two-day events. The conferences were organised around selected topics on which guest speakers presented and engaged in plenary sessions. Alongside this principal activity, industry suppliers exhibited products to conference participants. So for example, in the first data collection phase, one of the case companies (CryoCo) was observed presenting their cremation alternative, while in the second phase the other company (HydrolyCo) exhibited their technology at the same conference the following year. These events provided a means to establish multiple perspectives on cremation in general and radical alternatives in particular, with notes taken during the sessions and immediately after brief discussions with delegates.

[INSERT TABLE 2 ABOUT HERE]

The conferences also enabled the researchers to identify and approach potential research participants. Respondents interviewed included representatives from the new technology firms (each being interviewed in phases one and two of the study), industry bodies, crematoria operators and funeral directors. (Table 2 shows interview participants according to research phase). In-depth interviews lasting between 60-90 minutes allowed for a deeper understanding of the participants lived experiences (Marshall and Rossman, 1995) and were conducted using discussion guides, these acting as a checklist for topic areas covered (Patton, 1990). Themes included in the discussion guides varied according to study phase, moving from understanding disposal provision and cremation alternatives in phase one, to examining networking and radical innovation in phase two. Aside from this thematic difference, interview questions and structure were adjusted depending on the organisation represented as well as the respondent's field of interest and answers.

In-line with an abductive approach (Dubois and Gadde, 2002), primary data was combined with secondary sources and thematic analysis conducted in two stages. Analysis of data collected from phase one led researchers to literature on strategic niche management and radical innovation, in which the importance of networking was apparent. Scrutiny of data generated in the second empirical phase directed attention to progression in innovation phases and literature on network competence. This material was used to compare the knowledge and skills employed by the two case firms to engage organisations and the resulting resources from which they were able to benefit.

Findings

The data generated is firstly used to give an overview of the institutional regime and landscape of human disposal and present the cremation alternatives that the two companies sought to introduce. This frames the subsequent examination of the focal firms' network competence.

Control and provision of body disposal: regime and landscape interplay

The regime and service provision associated with body disposal vary between countries. In the United States, for example, once a corpse is declared dead, handling of the deceased is transferred to funeral director businesses. The funeral parlour manages almost every element of the funeral process, including the operation of cemeteries and crematoria (Walter, 2005). In the United Kingdom, while funeral directing is undertaken by commercial enterprises (and some have expanded into crematoria operation), the majority of the cemetery and crematoria are municipally run (Davies and Mates, 2005). The variation in control is significant, because those seeking to introduce change in body disposal must engage with commercial or municipal entities (or both) according to the form of control prevalent in a country.

Two factors that shape funeral and disposal practice are relevant to this investigation. Firstly at the landscape level, disposal reflects a country's cultural or religious norms. Cremation is the dominant disposal method in the United Kingdom and in the United States it is expected to account for 55% of all deaths by 2025 (Anonymous, 2011). Secondly and in relation to the funeral regime, disposal must comply with legislative requirements and industry practice. In North America legislation may be at the state level, while elsewhere it is at the national and (in Europe) the European Union level. In terms of industry practice, those involved in funeral provision are affiliated to professional associations or industry bodies. Codes of practice operated by industry bodies mean that there are minimum standards within

which funeral directors and crematoria operators must function. Industry bodies provide members with representation in consultation processes and act as conduits for information exchange. Individual funeral directors or crematoria operators may be receptive to innovation in disposal provision and therefore potential targets for alternative technologies. However firms seeking to offer innovative solutions also need to engage with religious bodies (landscape) as well as legislative authorities and industry associations (regime) as they can be influential in bringing new practices to market, promoting or resisting these depending on their members' interests.

Bringing to market radical cremation alternatives

Two new businesses ventures recently sought to introduce alternatives to cremation using technology based on cryogenics (CryoCo) and alkaline hydrolysis (HydrolyCo). Table 3 summarises the respective technologies and companies.

[INSERT TABLE 3 ABOUT HERE]

The similarity of the respective company's processes with cremation lies in the rapid transformation and reduction of the corpse. Both, however, might be classed as radical innovations because the technology of each is characterised by fundamental shifts (away from combustion) in the manner in which this transformation is brought about. Irrespective of the underpinning technology, each company claims sustainability benefits including improved environmental performance through reduced energy consumption and emissions.

As new business ventures, network competence is important for CryoCo and HydrolyCo to progress the innovation process, providing resource access and a means through which

activities can be undertaken. The discussion that follows centres on these companies' use of specialist knowledge and social skills to recruit development collaborators, interact with controlling and influencing organisations and develop links with key decision makers. The contribution of these network competences to stages in the innovation process is summarised in Table 4.

[INSERT TABLE 4 ABOUT HERE]

Recruitment of development collaborators

Neither company had operational alternatives to incumbent cremation systems, which meant that mobilising their network to enable technology adaptation was critical. Both companies drew from network competences to initiate and manage relationships. This allowed CryCo to progress the incubation, and HydrolyCo the acceleration phase of the innovation process.

As an R&D company, CryoCo used its scientific knowledge to screen potential collaborators and to signal to partners the standing of its cremation alternative. Communication skills, alongside CryoCo's past experience in commercialising R&D projects, enabled negotiations to establish the basis of collaboration with partners. This combination of *specialist knowledge* (technical and economic) and *social skills* resulted in the contribution of development expertise from third parties. Collaboration involved a university partner (UniLab) to determine the means by which humans remains could be rendered sterile, an international process technology company (ProcessCo) to develop equipment for particle reduction and an international supplier of gas-based technologies (AirCo) to adapt cryogenics for human disposal. Over a five year period, the embellishment of specialist technical and partner knowledge facilitated repeated technological and know-how exchanges and the coordination

of activities with the three partners such that by 2011 CryoCo had tested and piloted various parts of the process:

> 'We are a research and development company who have essentially put together a new technology for the funeral industry to take to their market'. (Managing director, CryoCo)

In the case of HydrolyCo, a business founded on technology developed originally for animal disposal, the company needed to establish relationships with partners who could facilitate the translation of its engineering and application experience. Again, this involved *specialist knowledg*e and *social skills*, but in HydrolyCo's case, the former consisted of technical and partner-specific knowledge. HydrolyCo was aware of MedClin, a North American medical research centre that had the first alkaline hydrolysis prototype for human disposal supplied by a company which had gone into receivership (Managing director, HydrolyCo). HydrolyCo's founder and engineering director used their application expertise and knowledge of MedClin to initiate contact and work with the clinic. This specialist knowledge facilitated technological exchanges with MedClin and solutions to difficulties experienced by the clinic with the prototype. Aside from relationship-specific tasks, HydrolyCo used technical and partner knowledge and social skills to enable cross-relational activities. Firstly, by observing the prototype installed at MedClin, HydrolyCo determined process improvements needed for a commercial production unit and conveyed these to EnginCo, its manufacturing development partner. Secondly, the company's intervention meant MedClin had a functioning unit and the clinic's director supported HydrolyCo during the commercialisation phase:

> ‘I contacted MedClin and it turned out their unit wasn’t working…we flew over, looked at the system, made some changes and managed to get it working quite well. So they were delighted with us and we’ve worked with them exclusively over the last four years because of the help we gave them and continue to give them’. (Managing director, HydrolyCo)

CryoCo and HydrolyCo are at different stages in the innovation process, but technical knowledge and communication skills are central to each company’s ability to initiate relationships and undertake exchange activities with development collaborators. A key distinction however, is that HydrolyCo’s existing partner knowledge as well as technical expertise and cooperation skills allowed the company to secure the engagement of an equipment user, critical to developing commercially viable units in the acceleration phase.

Interaction with controlling and influencing organisations

Essential to recognition of cremation alternatives are connections to organisations that affect body disposal. Interaction with religious bodies, industry associations, crematoria operators and funeral directors drew from *social skills*, and more specifically, communication, to facilitate relationship-specific tasks (initiation and information exchange) and cross-relational planning. So for example, with its technology in the incubation phase, CryoCo engaged different stakeholder groups to understand regime-level issues and created an advisory panel to guide the subsequent acceleration and commercialisation phases:

> ‘You’re using liquid nitrogen. Gas manufacturers in this country…. take in air and separate it out and nitrogen being 78% of air is actually virtually a waste

product, you are actually using the waste product for environmental benefit and I like that'. (Participant observation, Institute of Cemetery and Crematoria Management Conference 1)

CryoCo however delayed intense promotion of the process until it had an assembled pre-production unit. It is only then that CryoCo's managing director believes that it can signal its technical know-how, allowing it to engage credibly with industry organisations and the process to be observed.

Contrastingly, to progress the acceleration of its technology, HydrolyCo's founder combined *social skills* and *specialist knowledge* of the human disposal regime to introduce the company's process at events attended by crematoria owners/operators and funeral directors (the company website reported participation in eleven events in different English speaking countries over a five year period). The participation of MedClin representatives (the American medical research centre) on these occasions was important, contributing to the credibility of HydrolyCo's technology. The founder's communication skills and on-going information exchange via repeated presence at industry events enabled regular updates on HydrolyCo progress towards commercial installation, sharing of research results and participation in panel debates:

'He was part of a top table discussion…. on issues facing the industry…..he's a very good communicator. He's been very much a part of what we do for a long time now'. (Chief executive. Industry Body 2)

The voice and growing credibility established by HydrolyCo in North America and the United Kingdom resulted in recognition of the company's process as a potential alternative to incumbent cremation technology within the regime of human disposal and has contributed to some shift in the landscape within which disposal operates. In North America this is evidenced at the landscape level via the Catholic Church's examination of the ethics of alkaline hydrolysis (Mirkes, 2008) and changes in legislative provision within the disposal regime now allowing cremation alternatives in some states. In the UK disposal regime the Cremation Society of Great Britain changed its constitution to investigate and (where appropriate) promote alternative methods of human disposal (Chief executive, Industry Body 2).

Because CryoCo and HydrolyCo are at different stages in the innovation process, the purpose and scope of information exchange activities and impact of their communication skills varied. For CryoCo, which was at the incubation stage, these skills were used principally to gather information via interaction with representatives of the human disposal regime and landscape in the United Kingdom. HydrolyCo also gathered information, but to progress within the acceleration phase, the principal intent was to secure acceptance amongst controlling and influencing organisations.

Development of links with key decision makers

In the incubation, acceleration and commercialisation phases, CryoCo and HydrolyCo needed financial resource to fund activities, distribution capability to access customers and clients willing to use their technology alternatives. *Social skills* and *specialist knowledge* are important in executing relationship-specific and cross-relational tasks to access these

resources. However, in addition to initiating relationships, both companies use network competences to respond to the actions of others.

Response to other parties is particularly pertinent for CryoCo's access to financial resource and potential customers. The company was approached by an investment group, but using economic knowledge in information exchanges with the prospective backer, opted to reject its offer:

> 'An investment group wanted to take it under licence, which would have been perfect …but the terms and conditions were highly unsatisfactory and they weren't from the funeral industry....we wanted somebody who was aware of the sensitivities and understood the commercial drivers in that market'. (Managing Director, CryoCo)

CryoCo's rejection of this proposal delayed further development of the cryogenics process. While declining this approach, CryoCo responded positively to a Dutch funeral company (NLFuneralCo). The resulting cross-relational information exchange organised by CryoCo and involving itself, one of its development and supply partners and NLFuneralCo, convinced the funeral company of CryoCo's progress in applying cryogenics for body disposal. NLFuneralCo subsequently joined CryoCo's advisory panel. Its response to these two approaches suggests that in the incubation phase, CryoCo prioritised market development over financial certainty.

In HydrolyCo's case, interaction with controlling and influencing organisations was pivotal in securing financial backers, lead customers and distributors, thus enabling progression towards commercialisation. For example, HydrolyCo's founder was approached at a national

conference by the managing director of a major UK funeral business (EthicCo) because this alternative technology resonated with EthicCo's development and sustainability strategies. Technical and economic knowledge and communication skills used by both parties in ensuing discussions led to EthicCo becoming HydrolyCo's main financial backer (Managing director, HydrolyCo).

In the United States, having attended a HydrolyCo presentation, the president of an American cremation equipment company (EquipCo) invited HydrolyCo's founder to discussions with EquipCo's cremation division. Over a six month period, meetings between the companies, assessment of the process, and market research studies confirmed the commercial viability of the process and HydrolyCo's credibility (evidenced in their prior experience with alkaline hydrolysis, engineering expertise and collaboration with MedClin). The technical knowledge and communication skills used in repeated exchange and coordination activities between the two companies resulted in a distribution agreement, with EquipCo representing HydrolyCo in the United States, Latin America and Australia (Managing director, HydrolyCo). The announcement of this agreement combined with demonstrations of human disposal involving MedClin were pivotal in HydrolyCo securing its first commercial installation. These events persuaded a Florida-based funeral company (USFuneralCo) to consider alkaline hydrolysis and the company approached EquipCo with a view to adding this to its cremation provision (Johnson and Parmalee, 2010). Collaboration between HydrolyCo, EquipCo and USFuneralCo resulted in shipment of the first commercial version of HydrolyCo's equipment in 2010 and the first commercial operation of the process in Autumn 2011:

> 'This is a job in progress, we're learning, …our contact (in MedClin) is coming to give advice on the final steps…he'll also help with training funeral directors because

he's also a funeral director….with a passion for the technology'. (Managing director, HydrolyCo)

Financial backing is a crucial resource for CryoCo and HydrolyCo. Although the companies were at different stages of the innovation process, the ability to obtain financial support via relationship initiation and maintenance determined advancement beyond incubation. Faced with this obstacle, CryoCo had to maintain existing relationships to hold its position rather than initiate new and use existing relationships to progress towards market acceptance. Meanwhile HydrolyCo, having secured investment, used this resource to support its networking with development partners, controlling and influencing organisations as well as distribution partners and lead customers, thus advancing from incubation to commercialisation. Figures 1 and 2 show relationships in the incubation and commercialisation phases resulting from CryoCo and HydrolyCo's network competences.

[INSERT FIGURES 1 AND 2 ABOUT HERE]

Having examined the competences used in engaging networks of relationships to bring to market cremation alternatives, the final section considers how these findings relate to existing knowledge, their significance for radical sustainable innovation and suggests avenues for further research.

DISCUSSION

Radical sustainable innovation is challenging because of the substantive shift in technology platforms typically involved and the incompatibility of this technology with the prevailing infrastructure, user practices and regulatory frameworks (Schot and Geels, 2008).

Investigations of the transition from an R&D project to the successful introduction of radical sustainable innovation are frequently based on the management of innovation niches (Kemp *et al*., 1998). In line with criticisms of the protected nature of such niches (Möller, 2010), this investigation focused on the development of radical alternatives to existing cremation technology based on commercial projects. Here the transition from R&D project to viable niche commercial installation relied considerably on the engagement of actors within the body disposal regime (private enterprises, municipal crematoria, industry associations and regulators) and their ability to facilitate changes at the landscape level.

Theoretical contribution

Critical to radical innovation is the contribution of other actors in bringing new technologies to market (Aarikka-Stenroos and Sandberg, 2012; Story et al., 2009). Existing literature explains the structure and functioning of networks in radical sustainable innovation (e.g. Caniëls and Romiijn, 2008) but does not account for the way changes within them (e.g. the entry of new actors, resource sharing or activity performance) occur. This investigation brought together two areas of understanding, radical sustainable innovation and network competence to address this gap. The latter is now revisited – competence and then network competence and their manifestation in radical sustainable innovation.

Competence is explained as the ability to do something effectively as a result of capabilities (Carlsson and Eliasson, 1994). In an organisational setting, these consist of a mixture of knowledge as well as managerial and entrepreneurial skills (Penrose, 1959), the combination of which results in differing levels of capabilities and the performance of activities from the routine to the creative and strategically important (Collis 1994; Winter, 2003). Clearly these latter activities are critical to organisational performance and much academic interest has

centred on the dynamic capabilities associated with them (e.g. Teece, 2007; Winter, 2003). While Ritter (2006) characterises differing levels of marketing competences, such a distinction is lacking in relation to radical innovation and instead attention is centred on those classed as dynamic (e.g. Story *et al*., 2009). This is clearly logical given the very nature of radical innovation, and dynamic capabilities might equally be appropriate for the two focal companies as evidenced in their efforts to bring to market new product technology (Ritter 2006; Story et al 2009) for human disposal. However, considering the technical competence of each (Table 3), some distinction between them is apparent. CryoCo's core business activity is R&D directed at any market in which incineration technology can be replaced. This suggests creative thinking normally associated with dynamic capabilities as this organisation's routine behaviour pattern. Contrastingly, HydrolyCo's expertise lies in alkaline hydrolysis, here the basic product technology exists but a presence in the body disposal market does not. So for HydrolyCo, entrepreneurial orientation and opportunity search underpin its dynamic capabilities for product and market development.

This mixture of expertise and managerial/entrepreneurial skills can equally be used for ad-hoc reaction to unpredicted events which might contribute to organisational performance at the operational or strategic level (Ritter 2006; Winter 2006). For example, regarding financial backers, both CryoCo and HydrolyCo were presented with unexpected funding opportunities, the handling of which determined innovation progress. As a R&D company, CryoCo focused on development activities to the stage at which product and process technologies could be patented. The managerial decision not to pursue the investment group's offer meant that the 'routine' development activities towards patenting of its body disposal technology were delayed. HydrolyCo's decision in relation to funding opportunities was different, because its key objective was to establish itself as an alternative technology supplier in the body disposal

market. HydrolyCo had secured but not committed to a financial investor, so when the managing director was unexpectedly presented with the prospect of backing from a leading operator in the funeral industry, that opportunity was pursued. This reaction to an unpredicted event contributed to strategic level, dynamic capabilities, enabling HydrolyCo to continue with its entrepreneurial orientation and pursuit of opportunities in the body disposal market.

From competence in general, the discussion now revisits *network competence*. The literature review established network competence as the ability to initiate, use and maintain relationships, the performance of which is determined by a relational capability. Ritter and Gemünden (2003) and Walter *et al*., (2006) identify specialist knowledge and social skills (amongst other factors) in relationship-specific and cross-relational activities as contributing to innovation and the performance of university spin-off companies. However this understanding of network competence is not connected to stages in the innovation process, while Aarika-Stenroos and Sandberg (2012) only examine the R&D and commercialisation phases. This study addresses such gaps by showing the contribution of these knowledge and skills at incubation, acceleration and commercialisation phases of the innovation process. It could be assumed that changes in network configuration, resource combination and activity performance (Geels and Raven, 2006; Möller 2010; Story et al 2009) associated with radical innovation would require network competence underpinned by dynamic capabilities, and these would be most critical at the R&D, acceleration and incubation phases. However, this investigation does not distinguish between the different phases and this is something that subsequent research might examine.

A key question regarding network competence lies in whether existing relationships are needed to develop others. Pittaway *et al*.'s (2004) review of networking and innovation

literature implies this is so, an organisation's network competence being based on 'its existing relationships and network capability'(p. 146). Others however (e.g. Aarikka-Stenroos and Sandberg 2012; Ritter and Gemünden 2003; Story *et al*., 2009) simply confirm the importance of relationships to innovation, and while changes in network configuration are likely, the possibility of initiating and managing relationships in the absence of an existing relational resource is not considered. Findings from this study suggest that in progressing the development and bringing to market of radical cremation alternatives, existing relationships are important and contribute to the subsequent development of others. For example, HydrolyCo managers' prior exchanges with the North American research laboratory (MedClin), enabled the company to develop this relationship further and use the collaboration with MedClin to showcase its technical competence to others. Equally, the financial backing of a leading funeral business (EthicCo) helped HydrolyCo secure its North American distributor, which in turn contributed to its first commercial installation. CryoCo's team of development collaborators (set up by the company) persuaded a Dutch funeral company to consider cryogenics as a cremation alternative. However, compared to HydrolyCo, its acceptance as a possible supplier to the body disposal market was less marked and its ability to progress the innovation process more challenging because of the absence of internationally recognised partners.

Implications and limitations

This investigation supports previous research in showing that relational resources are key to progress in radical innovation and that managers would necessarily have to initiate and manage new relationships at different stages in the innovation process. Radical, sustainable innovation is affected by the interplay of niche, regime and landscape level factors so organisation cannot necessarily expect to have or try to initiate relationships with other parties

at these different levels. Instead, as part of their network competence, managers must judge which parties could undertake networking on their behalf (or indeed with them) to gain support at the different innovation stages. As part of this network competence, managers also need to assess the contribution that other individuals or organisations make to the innovation process. For example would a new collaborator facilitate entrepreneurial/strategic capabilities or alternatively more routine activities and expertise that are a necessary part of the innovation process?

A number of further research possibilities are apparent from the work undertaken in this investigation. Future research might seek to refine network competence according to whether the knowledge and skills used to initiate and manage relationships provide a relational resource that enables routine activities, ad-hoc problem solving or creative resource combination or strategy configuration. Equally, this connection between network competence and levels of capability might be examined at different stages in the radical innovation process.

The findings from this study of radical sustainable innovation and network competence are unique to the funeral industry using two new business ventures as the units of analysis. This does mean that some of the results are particular to the challenges of network entry and product introduction facing business start-ups. Nevertheless, the investigation demonstrates the role of relationship networks and more specifically the importance of network competence of actors in bringing radical sustainable innovations to market. Further research should build on this by examining network competence and radical sustainable innovation in other business fields.

The findings show the contribution of controlling and influencing organisations in determining the introduction of radical sustainable innovation in the funeral industry. Important findings in relation to this are the role of commercial innovation niches in bringing cremation alternatives to market. Studies in other business fields should seek to establish whether commercial niches complement or act as an alternative to the non-commercial projects normally used to foster radical sustainable innovation. With regards to body disposal, this investigation focuses specifically on radical alternatives to cremation and draws from data relating to funeral provision in North America and the United Kingdom where the structure of that provision varies. Further research should examine other radical sustainable disposal alternatives and in contextual settings that differ from those featured in this study.

CONCLUSION

Radical sustainable innovation as a means to dissipate environmental burdens is an important topic for academics and practitioners. Strategic niche management has been used to understand ways of bringing about change to technical and social systems to reduce environmental impact. Despite its widespread application in sustainable development, it has attracted limited attention in business research as a way to explore transformation at the niche, regime and landscape level. In business and management literature, networks and network competence are recognised as critical to change, including radical innovation. Understanding of networking and network competence is pervasive in the business and management academic domain but is not widely used in sustainable development literature. This investigation has brought together knowledge from two domains to develop understanding of an area which is of equal importance to both, namely the way in which relationships can be initiated and developed to realise radical sustainable innovation, to bring about change at the niche, regime and landscape level. Body disposal as the vehicle for the study is novel – a

context which is only now attracting interest amongst business academics and the discussion of which many might normally choose to avoid. Nevertheless, death is fundamental to man's existence and so warrants consideration in business marketing (as an industry and marketplace) and discussion amongst individuals, so that more considered decisions might be made when faced with disposal choices.

References

Aarikka-Stenroos, L. and Sandberg, B. (2012), "From new product development to commercialization through networks," *Journal of Business Research*, Vol. 65 No. 2, pp. 198-206.

Anonymous (1987), *Our Common Future. World Commission Report on Environment and Development*. Oxford University Press, Oxford.

Anonymous (2011), Cremation data and predictions: data trends. *Cremation Association of North America*. Available at www.cremationassociation.org. Accessed 3/10/11.

Caniëls, M.C.J. and Romijn, H.A. (2008), "Actor networks in strategic niche management: insights from social network theory," *Futures*, Vol. 40 No. 7, pp. 613-629.

Carlsson, C. and Eliasson, G. (1994), "The nature and importance of economic competence", *Industrial and Corporate Change*, Vol. 3 No. 3, pp. 687-711.

Chiu, Y.T.H (2009), "How network competence and network location influence innovation performance," *Journal of Business and Industrial Marketing*, Vol. 21 No. 1, pp. 46-55.

Collis, D.J. (1994), "Research note: how valuable are organisational capabilities?", *Strategic Management Journal*, 15 Special Issue, pp. 143-152

Cooke, P. (1996), "The new wave of regional innovation networks: analysis, characteristics and strategy," Small Business Economics Vol. 8 No. 2, pp. 159-171.

Davies, D.J. amd Mates, L.H. (2005), *Encyclopaedia of Cremation*, Ashgate, Aldershot.

Dubois, A. and Gadde, L.E. (2002), "Systematic combining: an abductive approach to case research," *Journal of Business Research*, Vol. 55 No. 7, pp. 553-560.

Geels, F.W. (2002), "Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and case study," *Research Policy*, Vol. 31 No. 8/9, pp. 1257-1274.

Geels, F.W. and Raven, R.P.J.M. (2006), "Non-linearity and expectations in niche-development trajectories: ups and downs in Dutch biogas development (1973-2003)," *Technology Analysis and Strategic Management*, Vol. 18 No. 3/4, 375-392.

Hellström, T. (2007), "Dimensions of environmentally sustainable innovation: the structure of eco-innovation concepts," *Sustainable Development*, Vol. 15 No. 3, pp. 148-159.

Ieromonachou, P. Potter, S. and Enoch, M. (2004), "Adapting strategic niche management for evaluating radical transport policies – the case of the Durham Road access charging scheme," *International Journal of Transport Management*, Vol. 2 No. 2, pp.75-87.

Johnson, B. Parmalee, T.A. (2010), "Alkaline hydrolysis: the next big thing?", American Funeral Director, September, pp. 14-21.

Kemp, R. (1994), "Technology and the transition to environmental sustainability," *Futures*, Vol. 26 No. 10, pp. 1023-1046.

Kemp, R. Schot, J. and Hoogma, R. (1998), "Regime shifts to sustainability through processes of niche formation: the approach of strategic niche management," *Technology Analysis and Strategic Management*, Vol. 10 No. 2, pp. 175-198.

Linton, J.D. (2009), "De-babelizing the language of innovation," *Technovation*, Vol. 29 No. 11, pp.729-737.

Loorbach, D. van Bakel, J.C. Whiteman, G. and Rotmans, J. (2010), "Business strategies for transitions towards sustainable systems," *Business Strategy and the Environment*, Vol. 19 No. 2, pp. 133-146.

Magnusson, T. (2003), "Commercialising cleaner technologies: the case of microturbine

Generators," *Technology Analysis and Strategic Management*, Vol. 15 No. 3, pp. 349-361.

McGrath, H. and O'Toole, T. (2013), "Enablers and inhibitors of the development of network capability in entrepreneurial firms: a study of the Irish micro-brewing network," *Industrial Marketing Management*, Vol. 42 No. 8, pp. 1141-1153.

Marshall, C. and Rossman, G.B. (1995), *Designing Qualitative Research*, Sage, Thousand Oaks.

Mirkes, R. (2008), "The mortuary science of alkaline hydrolysis: is it ethical?" *The National Catholic BioEthics Quarterly*, Vol. 8 No. 4, pp. 683-696.

Möller, K. (2010), "Sense-making and agenda construction in emerging business networks – how to direct radical innovation," *Industrial Marketing Management*, Vol. 39 No. 3, pp. 361-371.

Monaghan, A. (2009), "Conceptual niche management of grassroots innovation for sustainability: the case of body disposal practices in the UK," *Technological Forecasting and Social Change*, Vol. 76 No. 8, pp. 1026-1043.

O'Connor, G.C. and DeMartino, R. (2006), "Organising for radical innovation: an exploratory study of structural aspects of RI management systems in large established firms", *Journal of Product and Innovation Management*, Vol. 23 No. 6, pp. 475-497.

Partanen, J. Möller, K. Westerlund, K. Rajala, M. and Rajala, A. (2008), "Social capital in the growth of science and technology based SMEs," *Industrial Marketing Management*, Vol. 37 No. 5, pp. 513-522.

Patton, M.Q. (1990), *Qualitative Evaluation and Research Methods*, Sage, Thousand Oaks.

Penrose, E.T. (1959), *The Theory and Growth of the Firm*, Blackwell, Oxford.

Pittaway, L. Robertson, M. Munir, K. Denyer, D. and Neely, A. (2004), "Networking and innovation: a systematic review of the evidence," *International Journal of Management Review*, Vol. 5/6 No. 3/4, pp. 137-168.

Ritter, T. (2006), "Communicating firm competences. Marketing as different levels of translation," *Industrial Marketing Management*, Vol. 38 No. 8, pp. 1032-1036.

Ritter, T. and Gemünden, H.G. (2003), "Network competence: its impact on innovation success and its antecedents," *Journal of Business Research*, Vol. 56 No. 9, pp. 745-755.

Ritter, T. Wilkinson, I.F. and Johnston, W.J. (2002), "Measuring network competence: some international evidence," *Journal of Business and Industrial Marketing*, Vol. 17 No. 2/3, pp. 119-138.

Robertson, P.L. and Langlois, R.N. (1995), "Innovations, networks and vertical integration," *Research Policy*, Vol. 24 No. 4, pp. 543-562.

Schot, J. and Geels, F.W. (2008), "Strategic niche management and sustainable innovation journeys: theory, findings, research agenda and policy," *Technology Analysis and Strategic Management*, Vol. 20 No. 5, pp. 537-554.

Seidel, V.P. (2007), "Concept shifting and the radical product development process," *Journal of Product and Innovation Management*, Vol. 24 No. 6, pp. 522-533.

Story, V. Hart, S. and O'Malley L. (2009), "Relational resources and competences of radical product innovation," *Journal of Marketing Management*, Vol. 25 No. 5-6, pp. 461-481.

Teece, D.J (2007), "Explicating dynamic capabilities: the nature and microfoundations of (sustainable) business enterprise," *Strategic Management Journal*, Vol 28 No. 13, pp. 1319-1350.

Veryzer, R.W. (1998), "Discontinuous innovation and the new product development process," *Journal of Product and Innovation Management*, Vol. 15 No. 4, pp. 305-321.

Voudouris, I. Lioukos, S. Iatrelli, M. and Caloghirou, Y. (2012), "Effectiveness of technology investment: impact of technological capability, networking and investment's strategic importance," *Technovation*, Vol. 32 No. 6, pp. 400-414.

Walter, A. Auer, M. and Ritter, T. (2006), "The impact of network capabilities and entrepreneurial orientation on university spin-off performance," *Journal of Business Venturing*, Vol. 21 No. 4, pp. 541-567.

Walter, T. (2005), "Three ways to arrange a funeral: mortuary variation in the modern West," *Mortality* Vol. 10 No. 3, pp. 173-192.

Winter, S.G. (2003), "Understanding dynamic capabilities," *Strategic Management Journal*, Vol. 24 No. 10, pp. 1032-1036.

Yin, R.K. (2009), *Case Study Research: Design and Methods*, fifth edition. Sage, London.

Zeng, S.X. Xie, X.M and Tam C.M. (2010), "Relationship between cooperation networks and innovation performance of SMEs," *Technovation*, Vol. 30 No. 3, pp. 181-194.

Figure 1
Radical innovation and body disposal: using network competence for *incubation of technology* alternative

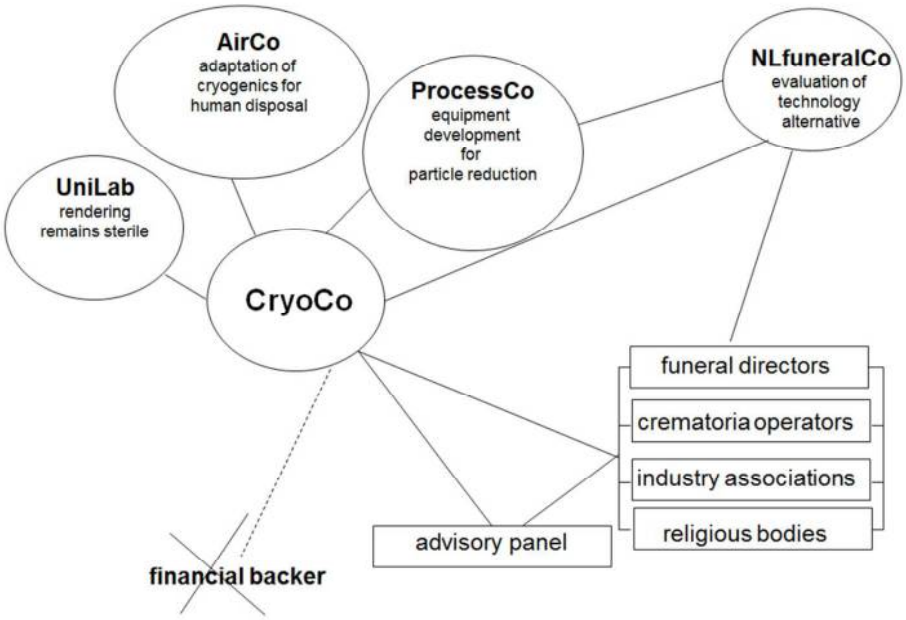

Figure 2
Radical innovation and body disposal: using network competence for *commercialisation* of technology alternative

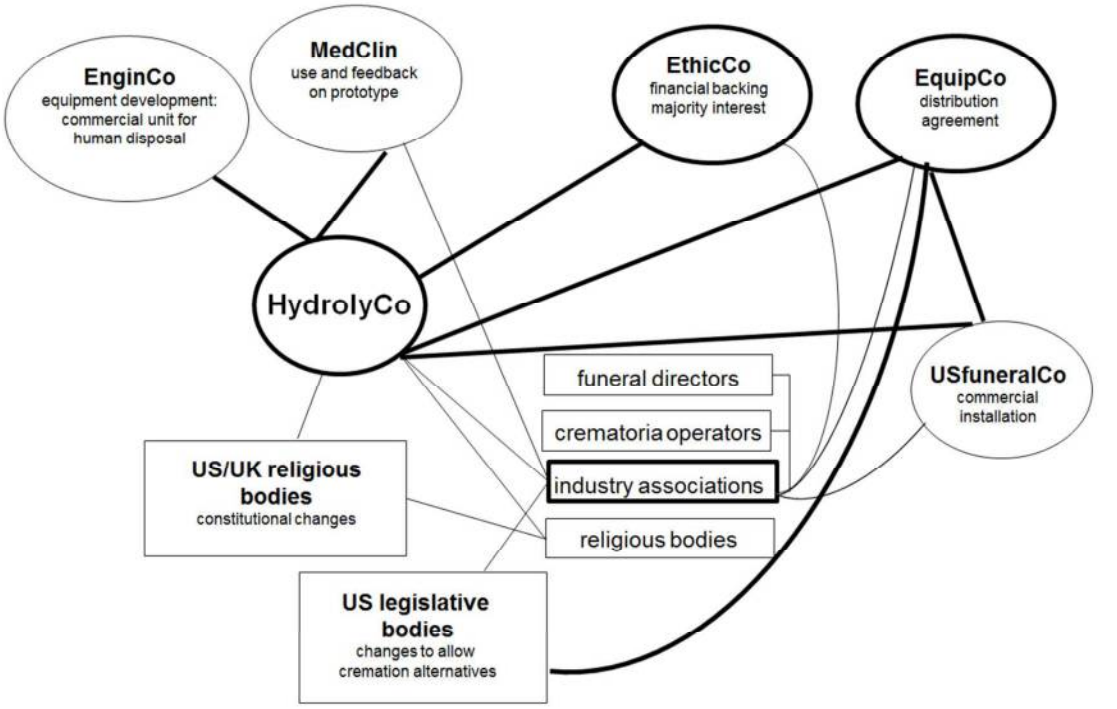

Table 1 Network competence in innovation studies: term, definition, knowledge, skills and activities

Author	Term and Definition	Knowledge	Skills	Activities
Aarikka-Stenroos et al (2011)	**network competence** company-specific ability to ♦build relationships with important partners ♦ access, mobilise and organise relational resource			
Partanen et al (2008)	**network mobilisation capability** ♦ ability to establish networks of partners.			
Ritter & Gemunden (2003)	**network competence** ♦ability to manage network of relationships effectively	**specialist** ♦*technical:* help understand partner technical needs and capabilities ♦*economic:* to determine inputs and costs/prices. ♦*partner organisation:* operations, personnel and resources. ♦*experiential* : resulting from partner interactions	**social** signalling of independent, prudent, useful behaviour via ♦communication ♦ conflict management ♦sense of justice ♦cooperativeness	**relationship-specific** ♦ *initiation*: identification via trade-shows, journals, tips from existing partners; ♦*exchange:* technological: information, products, know-how ♦*coordination:* creation and use of formal procedures, use of conflict resolution mechanisms **cross-relational** ♦planning; organising; staffing; controlling
Walter et al (2006)	**network capability** ♦ability to initiate, maintain & use relationships	**partner** ♦organised and structured information of supplier, customer , competitor	**relational** ♦communication ability ♦ conflict management ♦sense of justice ♦ cooperativeness	**coordination**: boundary-spanning activities connecting firms into mutually supportive interactions **internal communication**

Table 2 Primary data: phases and sources

PHASE ONE	*Understanding disposal provision and cremation alternatives*			
Sources	**Participant observation**		**Interviews**	
	Event		*Organisation*	*Respondent*
	Local Government Association. Burial and Bereavement Matters Conference		Industry body 1	Trust manager
			Public sector cemetery and crematoria 1	Bereavement services manager
			Public sector cemetery and crematoria 2	Site manager
	Institute of Cemetery and Crematoria Management. National conference		Public sector cemetery and crematoria 3	Director
			New technology supplier: HydrolyCo	Managing director
			New technology supplier: CryoCo	Managing director
			Funeral director 1	Owner
PHASE TWO	*Understanding networking and radical sustainable innovation*			
Sources	**Participant observation**		**Interviews**	
	Event		*Organisation*	*Respondent*
	Institute of Cemetery and Crematoria Management. National conference		Industry body 2	Chief executive
			Private sector cemetery and crematoria	Operations director
			New technology supplier: HydrolyCo	Managing director
			New technology supplier: CryoCo	Managing director
			Funeral director 2	Owner

Table 3 Human body disposal: cremation and technology alternatives

	Cremation	Alkaline hydrolysis	Cryogenics
Origins	• fire used in funeral rite since pre-historic times	• used to dispose of animal carcasses since 1990s	• 1970s patent expired; original development application failed
Technology	• burning at >800°C for 2 hours transforms body into gases and bone fragments	• 2-3 hour cycle time to dissolve corpse in heated alkaline solution and reduce skeletal remains to bone fragments	• cryogenic freezing, fragmentation, drying and sterilisation renders corpse into bone fragments
	• emission of chemicals and particulate matter controlled via filtering	• liquid from process disposed of via sewage system	
Alternative technology providers		**HydrolyCo**	**CryoCo**
History		• established in 2006	• established in 2006
Technological competence		• alkaline hydrolysis	• R&D
Strategic intent		• to bring alkaline hydrolysis to the funeral industry	• to develop industry alternatives to incineration technology

Table 4 Network competence: using knowledge and social skills for radical innovation in body disposal